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East," but we know that these are direct translations from the Arabic *shai*, meaning *thing*; p. 51, n. 4, Egyptian *hau* should be *ahau* for *heap*; p. 80, "Arabic numerals," elsewhere "Hindu-Arabic numerals"; p. 279, "develpoed."

In every way this work can be commended to the student of the history of science and to the student of Japanese civilization, and quite as much to the general reader, for the greater part of the story is not at all technical. May this beautiful product of a German printer, W. Drugulin, Leipzig, put out by an American publishing house, the joint work of a Japanese and an American, be symbolical of a better mutual understanding between these countries.

L. C. KARPINSKI.

The Development of Mathematics in China and Japan; Abhandlungen zur Geschichte der mathematischen Wissenschaften, Vol. XXX. By YOSHIO MIKAMI. Teubner, Leipzig, 1913. G. E. Stechert and Co., New York. x + 347 pages. \$5.50 net.

In 1910 Mr. Mikami published in the same series as this volume the work, *Mathematical Papers from the Far East*, which attracted favorable attention. The present work is of great importance because it brings systematized information about the history of mathematics in China and Japan, based upon a study of such original documents as remain. Regret must be expressed that the book is marred, even as the preceding work, by faulty English. The prefatory note by G. B. Halsted implies that the task of correcting the English was entrusted to him, but instead of correcting he says: "This is not the idiom of England nor of the United States nor have I striven so to cramp it." I take it that Mr. Mikami desired to bring out the work in idiomatic English and censure for the many errors of construction as well as the actually unintelligible statements can be attached only to the American scholar to whom the revision was entrusted. I think it is also fair to say that no American publishing house would bring out a work in the German language with such faults in usage, spelling, and construction as disfigure the work under consideration. The reviewer makes no attempt to list these errors.

There is no better evidence of the uncertainty which attaches to the ancient mathematics of China than the fact that Mr. Mikami's description of the *Arithmetic in Nine Sections* is entirely different (footnote, p. 10) from the description given by T. Hayashi in his *Brief History of Japanese Mathematics* (Nieuw Archief, Tweede Reeks, Deel VI, 306-307, not accessible to me). However this uncertainty is also characteristic of the history of ancient Hindu mathematics.

One of the most striking chapters of the work (Chap. IV) deals with *The Arithmetical Classic of Sun-Tsu*. The operations of multiplication and division and extraction of square root correspond almost precisely, mechanically, to these operations as taught in the early treatises explaining the Hindu art of reckoning. Thus in multiplication the unit of the lower number is placed below the highest digit of the upper number and the highest digit of the upper number is then multiplied by the lower number, the product being arranged in a line between the

two. Commonly the partial products in the treatises based upon the arithmetic of Al-Khowarizmi are placed above the two lines of multiplier and multiplicand, or on the upper line, this number being deleted in the course of the operation. Then the lower number is drawn back one digit and the work proceeds as before both in the Chinese work and in the European, which is based upon the Arabic and Hindu. The correspondence seems too striking to be wholly accidental but the connection has not yet been established. These calculations were effected doubtless with the *sangis* or calculating pieces upon some sort of abacus. The date of the treatise is left undetermined. The mathematician, Tai Cheng (1722–1777), maintains that the composition of Sun-Tsu's treatise could not ante-date the reign of the Han emperor, Ming-Ti (first century A.D.). Apparently Mr. Mikami construes this to mean that this work was composed about the first century of the Christian era, but no better evidence than the uncertain statement I have quoted is presented as to the age of the treatise. Somewhat similar treatises on the fundamental operations are found in the sixth century in China.

The Tsu Ch'ung-chih (fifth century) approximation for the value of π , namely 355/113, which is easily remembered from the sequence 1 1 3 3 5 5, should be familiar to every teacher of elementary mathematics and this might well be designated as the Chinese approximation if the name "Tsu Ch'ung-chih's approximation" seems too formidable. Other points particularly worthy of note include the *t'ai-yen* method for the solution of indeterminate equations, the *celestial element* process for the treatment of numerical equations, "Pascal's triangle" in China in the early fourteenth century, and Seki's development of the determinant idea in the seventeenth century. One *t'ai-yen* problem proposed by Sun-Tsu is to find a number which divided by 3, 5, and 7 respectively gives as remainders 2, 3, and 2 respectively. This is of particular interest because the same problem with the exception of the third remainder, 4 replacing 2, given by Leonard of Pisa in 1202, bears witness to contact between East and West. The thirteenth century studies by Ch'in Chiu-shao on approximation of the roots of numerical equations correspond closely to the methods of Newton and Horner.

Numerical errors are somewhat common in the work, as for example: 293 for 233 (p. 32); 30 9/60 for 36 9/10 (p. 54); 1337 1/20 for 397 3/4 (p. 54). The problem of the 10 foot bamboo which is broken at such a point that it touches the ground 3 feet from the stem (p. 23) is not found in Brahmagupta's work but twice in Bhaskara (Colebrooke, *Algebra . . . from the Sanskrit of Brahmagupta and Bhāscara*, London, 1817, pp. 203–204 and 64–65). There appears to be no point in stating that there is "no use of decimals" (p. 12) in these ancient works, for decimal subdivisions abound and decimal fractions as we have them, using the decimal point, would be most unlikely to occur. The explanation (p. 2) of the *chia-tsu* or sexagesimal system of numeration is not at all clear, and the notation requires ten numeral words in the first series whereas only nine are given.

Mikami compares Seki with Newton (p. 158). He speaks of "the Japanese Newton," and says "If Seki did not surpass Newton in his achievements, yet he was no inferior of the two" (Galileo being the other to whom this statement

refers). The reader will look in vain in Mr. Mikami's work for any justification of this effusive praise which flatters neither Seki, nor Newton, nor the Japanese. Seki was undoubtedly for his time and place an able mathematician, but the luster of his light is only dimmed by comparison with Newton or Galileo.

In concluding our review we wish to state again that Mr. Mikami has rendered a real service to the history of science by his exposition of the development of mathematics in China and Japan.

L. C. KARPINSKI.

PROBLEMS AND SOLUTIONS.

B. F. FINKEL, CHAIRMAN OF THE COMMITTEE.

PROBLEMS FOR SOLUTION.

SPECIAL NOTICE. In proposing problems and in preparing solutions, contributors will please follow the form established by the MONTHLY, as indicated on the following pages.

In particular, a solution should be preceded by the number of the problem, the name and address of the proposer, the statement of the problem, and the name and address of the solver.

The solution should then be given with careful attention to legibility, accuracy, brevity without obscurity, paragraphing and spacing, having in mind the form in which it will appear on the printed page.

Please use paper of letter size, write on one side only, leaving ample margins, put one solution only on a single sheet and include only such matter as is intended for publication.

Drawings must be made *clearly* and *accurately* and an extra copy furnished on a *separate sheet* ready for the engraver.

Unless these directions are observed by contributors, solutions must be entirely rewritten by the committee or else rejected.

Selections for this department are made two months in advance of publication.

Please send all solutions direct to the chairman of the committee.

MANAGING EDITOR.

ALGEBRA.

When this issue was made up, solutions had been received for 403-4-5-7-9 and 410. Solutions of 406 and 408 are desired.

413. Proposed by C. N. SCHMALL, New York City.

Apply Euler's transformation to show that

$$1 + 2^2x + 3^2x^2 + 4^2x^3 + 5^2x^4 + \cdots = \frac{1+x}{(1-x)^3}.$$

(BROMWICH, *Theory of Infinite Series*, p. 62, ex. 20.)

414. Proposed by R. D. CARMICHAEL, Indiana University.

Prove by means of an example that one of the series

$$\sum_{k=1}^{\infty} \frac{1}{c_k}, \quad \sum_{k=1}^{\infty} \frac{1}{c_k - 1}, \quad c_k \neq 0, 1,$$

may be divergent while the other is convergent.

415. Proposed by C. N. SCHMALL, New York City.

Show that

$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots = \frac{\pi^2}{8}.$$

(BROMWICH, *Infinite Series*, p. 187; and also p. 452, ex. 7, (iii)).